Medieval Islam
The Influence of Islam on Judaism and Christianity

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Abstract

Islamic civilisation at its cultural height, was not only characterised by a creative harmony between science and religion, but was open to learn from many older traditions, secular and religious. Prior to the European Renaissance, Islam inspired revivals in the religious and cultural traditions of Christianity and Judaism. The aim of this paper is to show how these spiritual reforms indicate a fundamental harmony between Islam, Christianity and Judaism. The paper also seeks to demonstrate that the religious reforms inspired by Islam were a necessary prelude to the European renaissance and the modern scientific revolution.

1. Introduction

There are many references within the Bahá'í writings to modern civilisation being essentially Islamic in origin. 'Abdu'l-Bahá, the eldest son of Bahá'u'lláh, the founder of the Bahá'í Faith, wrote in his book, The Secret of Divine Civilisation, that, "A careful and thorough investigation of the historical record will establish the fact that the major part of the civilisation of Europe is derived from Islam; for all the writings of Muslim scholars and divines and philosophers were gradually collected in Europe and were with the most painstaking care weighed and debated at academic gatherings and in the centres of learning, after which their valued contents would be put to use"[1]. 'Abdu'l-Bahá cited, John

[1] 'Abdu'l-Bahá, *The Secret of Divine Civilisation*, p 3

William Draper (1811-1882), as one of the few European historians who fully acknowledged the Islamic contribution[2].

The grandson of 'Abdu'l-Bahá, Shoghi Effendi, states that, "The so-called Christian civilization, of which the Renaissance is one of the most striking manifestations, is essentially Muslim in its origins and foundations... It is wholly unfair to attribute the efflorescence of European culture during the Renaissance period to the influence of Christianity. It was mainly the product of the forces released by the Muhammadan Dispensation"[3]. Earlier in the same letter, Shoghi Effendi suggests that Bahá'ís have the task of dispelling the "misunderstanding about Islam in the West", and show how the Islamic teachings have "guided the course of human development".

Of course, there is now much more well documented evidence published in the West on the subject of Islam being the inspiration to the European Renaissance than in 1875, when 'Abdu'l-Bahá wrote the Secret of Divine Civilization[4]. But much misunderstanding about Islam in the West still exists. The historian Norman Daniel, in his book, "Islam and the West", describes how many western prejudices about Islam were formed during the medieval period, and how they have persisted up to the present day[5].

The Holy Wars between Islam and Christianity from the beginning of the 12th century to the middle of the 13th century mark one of the most infamous episodes of religious fanaticism and hypocrisy in all religious history. For Christians, the religious frenzy of seven crusades, starting from the declaration of the first crusade in 1095 to the recapture of Jerusalem in 1249, involved not only the killing of Muslim infidels in the Holy Land, but spread to large scale massacres of Jews throughout Europe.

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2 'Abdu'l-Bahá, *The Secret of Divine Civilisation*, pp 92-3

3 Shoghi Effendi, letter to an individual believer dated April 27th, 1936, quoted in *Lights of Guidance*, by H. Hornby, no. 1004, p372

4 See for instance the collection of essays in, *The Genius of Arab Civilization, source of the Renaissance*, editor John R. Hayes, or in, Islamic Science by S. H. Nasr

5 See the chapter X, *'The Survival of Medieval concepts'*, Norman Daniel in, *Islam and the West, the making of an Image*

For the Papacy, the crusades were only one of a series of wars. Others had already been waged against the Eastern orthodox church and yet others were being fought against the Roman Emperor, and Kings of France and England. The general period for Christianity, is arguably, the lowest point in all its spiritual history.

But the interaction of religions is a complex phenomenon. Through all the killing and destruction, the crusaders were making religious and cultural discoveries, and the beginnings of what became known as a Christian revival was on its way. The very religion which the crusaders set out to defeat, exercised a profound influence on medieval Christendom, both in religious and cultural terms.

Islamic civilisation at its cultural height, was not only characterised by a creative harmony between science and religion, but was open to learn from many older ancient traditions, secular and religious. Prior to bringing about the European Renaissance, Islam inspired revivals in the religious traditions of Judaism and Christianity. The aim of this paper is to show that these spiritual reforms were essential prerequisites to the modern scientific revolution and demonstrate how the rise of a new religion can revive the older ones.

2. Islamic Science

The origins of modern science are not only European. There is a standard misconception about the growth of science - a popular myth which has come to dominate the European mind ever since the close of the Middle Ages. According to this myth, science originated in ancient Greece. It was then preserved by the Arabs while Europe was plunged into the "Dark Age". During this time, all scientific progress came to a halt. When science was transmitted back to Europe in the 13th century it began to bear immediate fruit. The revival of Greek learning in Latin Christendom caused an intellectual revolution in Europe, particularly through the works of Plato and Aristotle, and eventually culminated into the European Renaissance out of which modern science grew[6,7].

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[6] B. Russell, *History of Western. Philosophy*, p 420

Such notions of the history of science portray Europeans to be both the originators and developers of science, while designating the role of other cultures either as completely "barbaric" to science, or like the Arabs, to be "preservers" of what is seen to be essentially a European heritage. How this myth came to dominate the Western mind for many centuries is a complex question. No doubt the propaganda associated with the crusades provided much of the initial socio-political impetus to it, but that does not explain its duration up to the present day. One suspects that western technological and industrial supremacy ever since the industrial revolution has not helped to dispel the myth, but rather encourage it. Perhaps the dominant role played by Europe in scientific research and technological development over the last few centuries has blinded many into believing that Europe had always led the world in these areas. But whatever the reasons, the historical records indicate otherwise; modern science is very much a multi-cultural heritage. Not only were major developments to the growth science made from non-European cultures, but they came during the Middle Ages - precisely in the period which is most commonly regarded as a "Dark Age" for cultural and scientific development.

From the very beginning, the popular European myth on the growth of science is at best, oversimplified. The Ionian philosophers speculating on the primary substance of the universe, or the Pythagoreans finding mathematical harmonies in the universe did not arrive at their theories from a cultural vacuum. Living on the Eastern outposts of Greek colonies, they were brought into close contact with other cultures - older civilisations where important scientific developments had already taken place. The ancient Greeks themselves frequently acknowledged their debt to the cultures of Egypt and Babylon. One cannot deny the title of science for instance to pre-ancient Greek cultural achievements such as the invention of multiplication and division in Arithmetic, or to the techniques used to construct a 750 feet Pyramid base structure with only an error of less than 1 inch, or to the measuring of the seasons by using the time lapse between helical risings of the star Sirius as a fundamental unit. Quite simply, the ancient Greeks greatly added to science, but they did not create it. Their contributions in the art of deductive reasoning, in

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[7] A. Koestler, *The Sleepwalkers*, p 90-1

geometrical mathematics were invaluable to the subsequent development of science. Their translation of empirical laws into general mathematical formulae anticipated many developments in later science - centuries later. Yet in the final analysis, ancient Greek science was an important phase in the evolution of science, but not its parent-seed. There were many other contributions to science that were non-European in origin, and were made at other periods in history which proved to be just as influential to the growth of modern science as the ancient Greek contribution. The Middle Ages was such a time.

To designate the period from the collapse of Rome at the end of the 5th century AD to the beginning of the 12th century AD in European history as a "Dark Age", serves as a useful marker for historians and broadly speaking is justified. During this period, most of Europe was overrun by Germanic tribes whose invasions stunted cultural growth, embroiled European people in wars and feuds whose impact lasted well over 700 years. It put an end to the early period of the Byzantine empire which had begun with Emperor Constantine (288-337 AD) and under whose orbit fell several important centres of learning. But to apply the term "Dark Age" to describe the general state of science during the period of the Middle Ages is completely inaccurate. In fact the opposite is true. While most of Europe was undergoing a cultural dark period, science as a whole was undergoing a particularly enlightened one. While England and France were tormented with internal disorders and factional rivalries, and the churches of Europe were racked with controversies over religious doctrines such as the legitimate use of icons, the rulers of the Islamic Empire lived in magnificent luxury in Baghdad, the cultural capital of the world. By the 8th century, as Europe languished in the Dark Ages, the Muslim Empire reached from Spain and southern France to the borders of China and India, a spectacular fusion of diverse cultures and peoples, renowned for its patronage and promotion of learning and the arts.

The Islamic culture in vivid contrast to the rural, feudal and solemnly ascetic life of most of Europe, was urban, commercial, exotic, cosmopolitan and in a word - modern. At the western end of the Islamic empire, Cordoba in Spain was almost as large as Baghdad, and its suburbs extended twenty-four miles along the river-bank. Its streets were paved with stone and lit with lamps, there were public gardens and

fountains, a plentiful water supply, sewers, public baths and a library. This, compared with the rest of Europe, where the towns were muddy, undrained, without public water supplies or sanitation; where few people could read or write, and baths and soap were unknown.

Most important of all for the development of science - the Islamic civilisation was a melting pot for learning, where the cultural traditions of India, Persia, Babylon, Egypt, the Byzantium empire, ancient Greece, and the Roman Empire were brought together under the patronage of one language, one way of life, and one common faith. A Muslim in any one of the many centres of learning scattered throughout the Islamic empire had the opportunity of studying the scientific records of almost all the ancient preceding civilisations. The mathematics, the astronomies, the medicines, the philosophies, in short almost the whole corpus of ancient knowledge and wisdom which evolved over millennia, merged together under the one common lore of Islam. This multi-cultural legacy was not merely preserved in Islamic culture, but its multi-various elements were united together in a spectacularly creative way. The science that emerged from this medieval cross-fertilisation of ancient cultures was completely unique. It in many ways surpassed the scientific achievements of any one of the individual cultures that gave birth to it - including the Greek heritage. Islamic science is a crucial phase in the development of modern science. Many of the methods and techniques now taken to be indispensable to science were first conceived in the Islamic era. Islamic civilisation is incontrovertible proof that important elements within the development of modern science are non-European in origin and help to show that modern science is a multi-cultural legacy - and not a Greco-Latin one.

Take for example what would now appear to be the most basic of all prerequisites to any science, namely numbers. So powerful a contribution did Islamic science make in this area that our present decimal numerical system is still referred to as "Arabic". In ancient times, a numerical system was largely derived from some form of finger-reckoning. The Roman number system is a good illustration of this; the Roman sign for five for example is closely associated with the V-shape formed by the fingers held together and the thumb extended. Although additional symbols such as "C" designating the Roman centum (one hundred)

simplify the number representation, numbers are "bundled" together to denote larger ones - and the system is cumbersome to read at a glance. The more advanced Babylonian sexagesimal number system operated on a base of sixty, and used the local position of numbers to construct larger ones (their relative positions denoted different base units of sixty). Our method of dividing time derives from this number system - the counting of seconds, minutes and hours.

Although the Babylonian system was definitely an advance on finger-reckoning systems, it was not until the idea of "zero" appeared as part of a digit within the number, which the Babylonians had merely denoted by a "blank", that a revolution occurred within number counting. This decimal system of counting was first used by Indian mathematicians and passed on to the Islamic civilisation during the Middle Ages.

The contribution made by mathematicians working within the Islamic civilisation was to realise the inherent potential of the Indian decimal system, both to commerce and science, and to convert the number system into a visual code which allowed one to read a number at a glance. Al-khwarizmi, a mathematician working in Baghdad in the 9th century, wrote the first handbook on what became known as the "Arabic numerals". It was introduced to the West by Leonardo Pisa in the 13th century. The term "algorithm" commonly used in mathematics, derives from Al-Khwarizmi's name. Al-Khwarizmi demonstrated basic arithmetical operations through the use of the decimal number system, and also included discussions on the principle of squares and roots. Al-Khwarizmi was followed by other Muslim mathematicians. The role of these mathematicians in the development of science is much more than being "transmitters" as western accounts often suggest. Through their work, the West came to understand the power with which mathematical operations could be expressed by the Indian system of counting - a feature which is arguably as valuable as the invention itself. The magnitude of this contribution to the development of modern science is momentous. It is difficult to imagine the motions of the stars, the vista of distances, angles, laws of motion etc. that are now computed in modern science, expressible in terms of Roman Numerals. This Indian-Islamic computing device plays a vital role in the history of science.

Another field of mathematical enquiry developed within medieval Islamic civilisation is the field of Algebra. The term "Algebra" comes from an Arabic word meaning the reduction and combining of parts, and was used by Al-Khwarizmi as the title of his best known mathematical treatise. The development of Algebra proved to be indispensable to the growth of modern science - particularly in the advance of physics during the 17th century. The two main mathematical traditions which played a crucial role in the 17th century scientific revolution was the Geometry developed by the ancient Greeks, and the Algebraic tradition developed within the Islamic civilisation.

The 17th century French mathematician, René Descartes, brought these two mathematical disciplines together in a powerful union through the creation of co-ordinate geometry. Shortly afterwards, the English physicist, Isaac Newton, further unified them in the development of his differential and integral calculus. These kinds of developments laid the foundation of mathematical physics since the 17th century to the present day. The notion of mathematical equations is so fundamental to science that it is difficult to imagine scientific progress without them. The principles underlying mathematical equations and the scientific potential of Algebra was first realised a millennium ago within Islamic culture.

Al-Khwarizmi detailed the possibilities inherent in the idea of an equation: the idea of adding or subtracting equal quantities on either side and maintaining the balance - like a weighing scale; or the principle of finding an unknown quantity through establishing this equilibrium condition in the equation. Al-Khwarizmi gave the West their first example of equations, systematically classified according to basic problems. Mathematicians after Al-Khwarizmi dealt with more advanced problems in Algebra, like the famous Poet-Mathematician Omar Khayyam, who formulated and solved cubic algebraic equations.

Algebra formed an essential complement to Greek Geometry in the development of 17th century science. Since then, Algebra has undergone an even greater transformation, and has gradually become more and more abstract and yet at the same time, a more and more powerful mathematical tool. The former ancient Greek primacy of Geometry in the

mathematics of pre-modern times has, in the modern era, largely been overtaken by methods deriving from Algebra.

Another Islamic-Indian contribution to the field of mathematics, also vital to the development of modern science is the discipline of trigonometry. Although the ancient Greeks had classified angles in terms of a table of chords, it was not until the development of trigonometry, based upon expressing angles in terms of the ratio of the sides of a right-angled triangle - that angles were represented in terms of number ratios - and thus made the notion of angles less dependent on geometry, making them more abstract and flexible. Trigonometry was pioneered by Indian mathematicians, and once again illustrates a propensity of the Indian mind towards the more abstract. In mathematics, this tendency has proved to be immensely beneficial. Al-Khwarizmi published Indian astronomical tables where the trigonometric functions sine and tangent were employed. Later mathematicians and astronomers within the Islamic civilisation derived important mathematical relations between trigonometric functions of different angles, and along with planar trigonometry, also developed spherical trigonometry.

Tables of trigonometric functions were initially applied to measure angles within the field of astronomy - they were later used by the 16th and 17th century pioneers of modern science. Indeed, Copernicus devoted a complete section of his famous treatise "Revolutions" to the description of spherical trigonometry.

From the beginning of the 17th century scientific revolution, the power of trigonometry as a mathematical aid to physics and astronomy was immediately recognised, and trigonometry soon developed into a subject in its own right. It greatly aided the mathematical description of the laws of motion in Physics, and became a powerful and flexible way of expressing the phenomena of periodicity. The significance of this perhaps needs some explanation to the non-scientist. Wherever one looks, one cannot but help observe wave-like periodic motion in Nature. From the motion of ripples in a pond to the twinkling of a star (light is a wave of electromagnetic energy), Nature is filled with energy vibrating in periodic motion. Thus it was not until periodicity was made quantifiable, through the invention of trigonometry, that fundamental laws of Nature were expressible in

mathematical terms, and it is precisely this kind of advance in science which is recognised to be one of the key developments of modern science: namely its ability to describe Nature in more and more profound mathematical terms.

The mathematical developments undertaken within Islamic science in many ways surpassed the mathematical achievements of ancient Greeks. They opened up the possibility of describing Nature in more advanced and general mathematical terms, and paved the way for the scientific revolution of the 17th century. Their lasting impact on the modern world is evidenced by the fact that we still use them: the decimal system of numbers, the methods of Algebra and trigonometry.

The contributions of Islamic science in the field of optics is a good illustration that significant aspects to the "modern scientific method" were developed in the middle ages, within the Islamic civilisation, and not only in the 16th and 17th centuries in Europe. The most famous Islamic mathematician-physicist in this field was the 11th century born Ibn-al-Haitham, known as Alhazen in the Latin speaking world. Alhazen made discoveries that went well beyond the ancient Greek studies in this area, and at the same time tested his mathematical theories with a systematic method of experimentation. He inspired men like the English scientist-philosopher Roger Bacon in the 13th century to carry out similar scientific experiments, and also drew praise from men like the 15th century Italian Renaissance artist-engineer Leonardo da Vinci, and the 17th century German astronomer Johan Kepler for his contributions to science. Alhazen's theories in optics laid the foundation of the principles of perspective in the visual arts and his authority in the field of optics lasted well into the 17th century where it was further developed by Isaac Newton.

The Greeks had assumed that rays of light originated from the eye, whereas Alhazen established the fact that they leave the luminous object observed by the eye. He gave an accurate and detailed account of the operation of the eye and how it functioned. He also generalised the laws of the reflection of light from plane mirror surfaces to concave and parabolic ones, and related the laws of refraction to the solid density in which the light was deflected. This latter observation was extended to describe the

influence of the atmosphere on the light from luminous objects in the sky. He modelled problems in optics by mathematics. One such problem led to him solving a 4th degree algebraic equation by geometrical means and became known as the "Alhazen Problem" in the Latin speaking world. Performing experiments on his ideas, he constructed ingenious mechanical apparatus, like steel refractor lenses. In all this work, Alhazen displayed a degree of mathematical and experimental rigour which had not existed in ancient science and which greatly contributed to the development of modern science - six centuries before the emergence of the scientific revolution of the 17th century.

3. Man and Cosmos within Islamic Philosophy

The dramatic cultural differences between Latin Europe and the Islamic Civilisation in the early Middle Ages were reflected in their respective philosophies. The invading barbarians from the north obliterated almost all trace of ancient learning from most parts of Europe for over 600 years - only a few ancient manuscripts survived. Prominent among these were some of Plato's writings. During the collapse of Rome, a Nubian priest, St Augustine (345-430 AD) formulated a synthesis between Plato's philosophy and Christian theology which came to dominate Christian thinking up to the end of the first millennium AD. This "Neoplatonic" philosophy, as it is often termed, tended to emphasise the moral and spiritual side of man not simply alongside the study of Nature - but in place of it. Broadly speaking, the exercise of Reason to understand the operation of Nature was seen as a temptation to Sin. It was regarded with suspicion, as something which inherently detracted from man's main task, namely moral salvation.

It is important to realise here that the "Neoplatonic" philosophy that came to be associated with Augustine, did not regard thinking about the physical world as a possible way of uncovering deeper eternal truths, as Plato had taught, but looked upon the contemplation of the natural world as inherently sinful - it tended to divide man's moral nature from the rest of the cosmos. In Plato's philosophy although the natural world was an imperfect copy of the higher world of the Forms - there was nevertheless

the possibility, with the use of man's rational faculty, of finding eternal divine harmonies within it.

Just to what extent the division between science and religion in the Neoplatonic philosophy was inspired by Augustine himself is not clear. He himself explicitly stated that where there is a direct clash between a scientific fact and religious scripture, the religious scripture should be interpreted allegorically, and the scientific fact should be accepted. But where there is a clash between a scientific theory and scripture, the scriptural text should be read literally, and the scientific theory should be rejected[8]. But this distinction between a scientific theory and a scientific fact is of course, a matter of interpretation. Augustine for instance, did not accept the sphericity of the earth and the existence of the antipodes, because he thought it was in conflict with the unity of the human race, which was a teaching of the Bible[9]. Belief in a spherical earth had been accepted by many philosophers of ancient times such as Plato, but in the third and fourth centuries A.D, the belief in a flat earth became popular. Augustine in this respect, not only makes a poor judgement with respect to a scientific theory, but is also taking a questionable interpretation of biblical scripture. It is not clear why the belief in a spherical earth should contradict the Christian belief in the unity of the human race.

There are also other elements in Augustine's philosophy which encourage a division between science and religion. For Augustine, understanding the operation of Nature was regarded as "knowing for knowing's sake" and a temptation to be avoided:

> "At this point I mention another form of temptation more various and dangerous... there can also be in the mind through those same bodily senses, a certain vain desire and curiosity, not taking delights in the body, but of making experiments with the body's aid, and cloaked under the name of learning and knowledge... Pleasure goes after objects that are beautiful to see, smell, taste, touch; but curiosity for the sake of experiment can go

[8] Augustine, *"City of God"*, p xxxiii,

[9] ibid

> after quite contrary things, not in order to experience their unpleasantness, but through a mere itch to experience and find out... Thus men proceed to investigate the phenomena of nature - the part of nature external to us - though the knowledge is of no value to them: for they wish to know simply for the sake of knowledge... Certainly the theatres no longer attract me, nor do I care to know the course of the stars..."[10]

Here Faith is put above Reason. Both Reason and the world of Nature are separated from man's spiritual purpose. The dominant theme in Augustine's theology is Sin, the Fall of Man from Grace, his subsequent depravity and the Redemption possibility. In contrast to the Pythagorean belief of purifying the soul through the study of Nature, Neoplatonic theology seems to have the notion of purifying the soul by denying the world of Nature, or more precisely in the context of science, denying the impulse to study Nature. In another passage, Augustine states:

> "When... the question is asked what we are to believe in regard to religion, it is not necessary to probe into the nature of things, as was done by those whom the Greeks call *physici*; nor need we be in alarm lest the Christian should be ignorant of the force and number of the elements - the motion and order and eclipses of the heavenly bodies... and a thousand other things which those philosophers either have found out or think they have found out... It is enough for the Christian to believe that only the only cause of all created things...whether heavenly or earthly is the goodness of the Creator, the one true God."[11]

Although Augustine does not explicitly oppose scientific investigation, he warns against the danger of it becoming an end in itself, without serving the higher spiritual purpose, his philosophy was later interpreted by the medieval Christian community as opposing scientific enquiry. His

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10 A. Koestler, *The Sleepwalkers*, p 90-1

11 T. Golstein, *The Dawn of Modern Science*, p 57

theology was used to set religion against science for over 600 years in medieval Europe.

The anti-science theology of the church was not the only barrier to the development of science in early medieval Europe. The constant feuding, often involving wars led by ecclesiastical authorities against secular rulers did not create the stable social conditions under which science could flourish. Towards the end of the first millennium AD, the Papacy had succeeded in extending its dominion over a significant number of territories. These worldly concerns of the church were pursued in parallel with the austere world-denying salvation doctrine formulated by St Augustine, and were somehow set apart. Both these contradictory concerns, in their own ways, retarded the growth of science in Europe.

Shortly after Augustine's death, a monastic movement was started by St Benedict. The Benedictine Order, based upon withdrawing from the world and its inherent Sin, and instead, concentrating upon individual Salvation, was entirely in keeping with Augustine's philosophy. Yet at the same time, the Benedictine Order was cojoined to the political power struggles of the papacy. A Benedictine monk, later known as Gregory the Great, became Pope at the end of the 6th century and greatly expanded Papal power and its dominions. He was hostile to all forms of secular learning and was able to maintain a world-denying salvation theology while at the same time engaging in the expansion of Papal territories by acts of war[12].

The split-mind mentality of the early medieval outlook in Europe is also illustrated by the two different types of geographical maps that were then in circulation. On the one hand, the earth was portrayed as a tabernacle spread over areas which had no geographical existence, such as the garden of Eden - but had a theological significance; whereas on the other hand, there existed the geographically accurate Portolano charts which were used by Mediterranean seamen[13]. One type of map was almost entirely theological, while the other was entirely geographical. Both these maps, completely unrelated, existed side by side.

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12 B. Russell, *History of Western Philosophy*, p 372

13 A. Koestler, *The Sleepwalkers*, p 103

The divided worlds of the early middle ages also extended to cosmology. The universe was seen as a series of heavenly concentric rings along which the planets and the sun revolved around the earth. Each orbit consisted of a perfect circle with its axis through the earth's centre. Beyond the outer sphere, the ninth sphere, lay God's home the Heaven - or "Empireo". Although it was impossible to reconcile this cosmology with observation, the apparent irregularities of the orbits of the planets were dismissed as unimportant - the senses after all were part of a corrupt world which merely led man to commit sin - the senses were liable to deceive the true believer. The world had been corrupted by Man's fall from grace. From that time, the seasons appeared, earthquakes scourged the earth, disease and famine became rife - and if events in the night sky did not entirely fit into the scheme of the medieval heavenly cosmos, or if the coastlines of the continents did not appear on the medieval heavenly maps - this was due to the corrupt nature of man, a result of the First Sin.

Another dominant feature of the early medieval mind was that it moved within well-defined boundaries: in space; in time; and in terms of knowledge. In space, the ninth sphere was thought to act like a ceiling beyond which the physical universe did not extend. In time, the universe was believed to have been created some 5000 years in the past. The date of this Genesis act was thought to be clearly indicated in the Bible. The future of the universe was also seen to be finite - limited by the second coming of Christ, which the medieval mind had expected to occur in its foreseeable future (within generations). Religious knowledge was thought to have been revealed once and for all in biblical Scripture, while knowledge of Nature was thought of as being once and for all discovered by the Ancient Greeks.

This latter point is vital to the understanding of the history of science. For the early medieval European mind, scientific knowledge had been completed and was closed - just like their conception of religious truth. Science was not a matter for open investigation. Where it was to be pursued at all, it was regarded to be a matter of reference and classification. The Ancient Greeks came to have supreme authority - the revealers of Gospel truth in matters of science. Knowledge of the natural world was not a goal that the early medieval European mind attached a great deal of importance to, but if it were sought, it was to be sought in

the writings of the ancient Greeks, particularly in the writings of Plato. It is for reason of these "finite" features in the early medieval mind, that its world-view has sometimes been referred to as the "walled-in universe" - like a medieval town's outer wall which marked a clear physical enclosure around its inhabitants, the early medieval Christian mind placed mental boundaries upon its own thinking.

The early European medieval walled-in universe contrasted completely with the world-view of medieval Islamic culture. Within medieval Islam, the acquisition of knowledge was regarded to be religious injunction which Muslims were expected to follow. Knowledge was seen to be a divine attribute. The Muslim believed that only God possessed perfect or infinite knowledge, but since in Islamic tradition, as in Christian tradition, man was created in God's image: that God had breathed His spirit into man (S. XV:29), then man in striving to make himself more God-like would naturally strive to attain more knowledge. Knowledge in the medieval Islamic world was looked upon as an open-ended enquiry, and was inextricably bound to regarding Nature as part of God's handiwork and creation:

> "It is He Who hath created for you all things that are on earth; moreover His design comprehended the heavens, for he gave order and perfection to the seven firmaments; and of all things he hath perfect knowledge." (S. II. 29)

In the Quran it is also stated that: "Are those who know equal with those who know not?" (S. 39:9). Such statements gave rise to many hadiths (sayings) in Islam which encouraged the attainment of knowledge. For instance, it was said that: "the quest of knowledge is obligatory for every Muslim..", or that "verily the men of knowledge are the inheritors of the prophets", or "seek knowledge from the cradle to the grave". Injunctions such as "seek knowledge be it even in China" explain why Muslims were not only open to assimilating the learning of ancient cultures, but considered the gathering of such learning to be a sacred moral duty[14].

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[14] , H.M. Balyuzi, *Muhammed and the Course of Islam*, p 291

In the Quran the "order and proportion" in the world of Nature, extends to the soul of man and is related to his task of soul-perfection:

> "By the sun and his glorious splendour; by the moon as she follows him, by the day as it shows up the sun's glory; by the night as it conceals it; by the firmament and its wonderful structure; by the earth and its wide expanse; by the soul and the proportion and order given to it; and its enlightenment as to its wrong and its rights; - truly he succeeds that purifies it..." (S. XCI:1-9)

This celestial harmony in the universe and its natural link to the inner character of the soul is a central pillar of Islamic metaphysics: man is a natural part of the cosmos. Both man and the cosmos are signs of God, and both meet in the world of God. It is not just given to man to follow religious laws but also inherent in his character to share in the knowledge of "order and proportion", both in the cosmos and within his soul. It is a complete man, both moral and intellectual who looks to God for this unity:

> "Who hath created, and further given order and proportion; who hath ordained laws, and granted guidance"
> (S.LXXXVII:1-3)

Unity - at all levels, social, individual, cosmological is the alpha and omega of Islamic teaching. Both the universe and man are viewed as ultimately noble and spiritual. In a well-known verse in the Quran, God is presented as the "Light of the Universe" and at the same time a "Lamp" shining within the soul of man where his "radiance" is revealed in "layer upon layers" of light:

> "Allah is the light of the heaven and earth. His light may be compared to a niche holding a lamp: the lamp is encased in glass, the glass shines like twinkling star. Its sacred oil... is luminous though the fire itself does not touch it. Thus we see his radiance in layer upon layer."(S.24:35)

Although the "Lamp" in this passage is often taken to refer to the prophet Mohammed, it is clear that it also refers to an inner lamp - one that shines within the soul of man. There is then, a profound harmony between the moral life of man and the study of the cosmos in Islamic tradition: the moral side of man is linked to God's presence within the soul of man - the divine spark within. The exercise of Reason unveils the hidden signs of God in the universe. Man is the meeting point between two universes, the universe within him, and the universe external to him. Both find a natural union in Islamic Faith - founded ultimately on divine unity.

In another famous passage from the Quran this unity is explicitly stated: "We will surely show them Our signs in the world and within themselves"(S. 41:53) and in a well-known Islamic hadith it is stated that: "Dost thou think thyself a puny mortal form, when the universe is folded up within thee?"[15]. Such statements explain why knowledge of Nature in the Islamic civilisation was not a matter that was fixed by ancient authority as it had been for the early medieval mind in Christendom - for on matters of science as well as religion, only God was regarded as the ultimate authority.

Islamic philosophers, while encouraged to seek out knowledge and wisdom from wherever it came, did not regard it as final and complete but subjected it to critical review - looking always to develop it. This also explains the enthusiasm with which the world of Nature was studied in the Islamic civilisation. Nature was looked upon as a garden, rather like the heavenly gardens depicted in the Quran that await the devoted Muslim, whose multi-various forms, whose numerous "order and proportions" all reflect the presence of a heavenly light in the cosmos - and at the same time, shine within the soul of man, "layer upon layer".

The contrast between Christians and Muslims was also apparent in the way they regarded one another. While Christians were generally hostile to Muslims, and frequently justified their war against them by describing Muslims to be followers of the "Anti-Christ", Muslims had a much more enlightened view of Christians. In the Quran, Jesus is described as a

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[15] Attributed to Hussayn Ali, quoted by Bahá'u'lláh in, *The Seven Valleys and Four Valleys*, p 34

righteous prophet (S 6:85), one having the same rank as Mohammed himself. Where the prophets are mentioned, the Quran explicitly states that "we make no difference between one and another of them" (S 2: 136). The disciples of Jesus are described as Muslims (S 5:111). Muslims are explicitly enjoined not to dispute with Christians, since their God is one and the same: "And dispute ye not with the People of the Book... But say, "We believe in the Revelation which has come down to us and in that which came down to you; ... Our Allah and your Allah is One..." (S 29:46).

The light of Islamic learning only gradually filtered through into medieval Europe over a period of several centuries. It took four complete centuries before European thought was to become fully set aglow with the new Islamic spirit of learning.

At first, around the end of the first millennium AD, only isolated rays penetrated the ascetic gloom of the medieval Christian European mind; in the twelfth century, as a result of the contact made through the crusades, more Europeans were attracted to the Eastern light, and undertook journeys to find it; in the 13th century, schools of thought grew up in Europe which started to reject the former Augustinian theology for a new one based upon the Islamic world-view; and in the period from the 14th to the 16th centuries, the influence of the Islamic civilisation on Latin speaking Europe effloresced into the European Renaissance.

One of the first Europeans to seek out Islamic learning was a Frenchman known as Gerbert of Aurillac. He went to Catalonia in Spain to study Islamic mathematics and astronomy in the 10th century. His journey to learn from Muslims became famous, for in 999 AD he ascended to the Papal throne and contributed towards raising the appreciation of scientific study amongst the medieval Christian clergy. The historian, David Knowles, writing on the influence of Gerbert of Aurillac, states that, "The first great name in the history of medieval thought is that of Gerbert of Aurillac, who was master of the school of Rheims c.972, and ended his life as Pope Silvester (999-1003 AD). In his writing on logic, and still

more in his mathematical interests and his use of Arabian sources, he was the harbinger of many new things"[16].

In the 12th century, a steady trickle of European scholars undertook the journey across the French border into Spain and across the Mediterranean sea to Sicily, in order to translate Arabic texts into Latin. One such man, an Englishman named Adelard of Bath, brought back a collection of manuscripts from his travels, which included Greek mathematical treatises such as Euclid's famous book, "Elements". But it was mainly the underlying philosophy behind Islamic science that these scholars brought back to Latin speaking Europe at this time. The mathematics that was then in use in medieval Islamic culture was not properly appreciated until after the 14th century onwards in the rest of Europe. In contrast to most Europeans of his time, Adelard of Bath declared:

> "Of course God rules the universe, but we may and should enquire into the natural world. The Arabs teach us that."[17]

Adelard of Bath stated that he had learned to put Reason above ancient authority from his Arab teachers in matters of natural knowledge, since in fact the ancients, who possessed authority, had themselves gained it through the operation of Reason.

During the gradual reconquest of Spain launched by Christendom in the 12th century, European scholars began to discover the glitter of the Orient - coming from their solemn ascetic perspective, it must have seemed as if suddenly a window had been opened up on to an exotic life of a new world. In the territories that had been reconquered, traces of Islam could be found: in the elaborate ceramic decor of colourful facades, under the horseshoe arches, the gardens, the mosques - and most important of all for the development of science - in the libraries.

In the Islamic centres of learning the medieval European scholars found a wealth of ancient learning, together with insightful commentaries,

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[16] D. Knowles, *The Evolution of Medieval Thought*, p 85-6

[17] Adelard of Bath, edited by C. Burnett, p 16

containing a vast array of scientific material which had been completely unknown to the Latin speaking world. A translation centre was initiated at Toledo by Alfonso VII, King of Castile and Leon, a farsighted monarch, who thus greatly aided the flow of Islamic learning to other parts of Europe. The overall effect of this transmission of learning was to start an intellectual revolution without parallel in European history.

In the 12th century, although the benefits of Islamic science were still dimly recognised, a school of learning was founded in the French town of Chartres, close to Paris. The school was originally founded by Fulbert, a pupil of Gerbert of Aurillac. Fulbert was a bishop in Chartres from 1006 to 1028 AD and became well known for laying down a programme of a wide literary and philosophical culture, harmonised to biblical teachings.

At Chartres, the very beginnings of an intellectual revolution started to take shape in Latin speaking Europe. Soon afterwards, the first European universities at Pisa, Paris, Oxford, Bologna and Padua were modelled on the Islamic centres of learning in Baghdad and Cordorba.

The scholars working at the school of Chartres, influenced by the newly acquired sources of Islamic-Greco learning that found its way across the French border from Spain, began to articulate a philosophy based upon the fundamental harmony between Reason and Faith. William of Conches, a leading figure in the Chartres school of learning stated:

> "I take nothing away from God: He is the author of all things, evil excepted. But nature with which He endowed His creatures accomplishes a whole scheme of operations, and these too turn to His glory since it is He who created this very nature."[18]

He had clearly been influenced by the Islamic injunction to seek knowledge when he stated that: "To seek the reason of things and the laws of their origins is the greatest mission of the believer"[19].

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[18] T. Goldstein, *The Dawn of Modern Science*, p 82

[19] ibid, p 87

The school of Chartres, a religious institution, was one of the first in medieval Latin Christendom to be influenced by Islamic learning. The commonly held notion today that the medieval church only retarded the growth of science is an inaccurate simplification of the state of science in the medieval period - a frequent modern misconception. It is true that the scholars at Chartres did receive religious opposition to their new philosophy, but in their defence, they appealed to the very same authority from which the opposition drew - namely Christian scripture. They emphasised aspects within Christian scripture which were different to the austere ascetic world-denying ones. They stressed the harmony of Reason and Faith, and not the rejection of Reason in the name of Faith, as the medieval followers of Augustine's theology had tended to do. The scholars of Chartres did not make any major scientific discoveries, but they do mark a significant change in the intellectual climate of medieval Christian Europe. They can rightly be regarded as the first scholars within a centre of learning in Latin medieval Christendom which arose to redress the imbalance between Reason and Faith that prevailed in the early middle ages in Europe, and as such, represent the first major wave of Islamic influence in Christian Europe.

4. Scholastic Harmonies

In 13th century Latin speaking Europe, the steadily increasing influence of the Islamic civilisation gave rise to a distinctive philosophical school of thought known as "scholasticism". Accounts of scholasticism in the history of science often present it as an alliance between Aristotle's philosophy and Christian theology. It is claimed that the rediscovery of Aristotle's writings in Europe through Latin translations (made from Arabic texts) started a major European intellectual revival, of which scholasticism formed the first part. Aristotle's vast array of empirical studies on Nature, his use of rational and logical principles to classify and catalogue these observations, are thought to have loosened the hold of Augustine's "world-denying" theology over the medieval Christian mind[20]. But this view betrays an overt European bias. It is undeniably true that

[20] A. Koestler, *The Sleepwalkers*, p 109

Aristotle's writings exercised a strong influence over the 13th century scholastic minds - he was the most respected of all philosophers and was simply known as "The Philosopher", just as St Paul was referred to as "The Apostle". But having recognised this fact, it is also true that the scholastic system of philosophy in all its essential characteristics, existed long before the 13th century Christian "schoolman" had "rediscovered Aristotle".

For over three centuries immediately preceding the 13th century, Islamic philosophers had pioneered the integration of Greek philosophy with Islamic theology, gradually refined the resulting metaphysics, and passed it on to the Latin speaking world in the form of commentaries on major Greek works, or in the form of theological writings that accompanied numerous Islamic scientific treatises. It is a testimony to the profound unity existing between the Quran and Bible - often poorly acknowledged by Christians and Muslims themselves, that Christian scholasticism in all its major features, is identical to Islamic scholasticism. There is indeed considerable irony in this fact, since medieval Christendom had launched a series of crusades - Holy Wars against the Islamic "infidels". Yet increased contact with these "infidels" not only "civilised" the Christian world in matters of science and philosophy, but also helped to initiate a reformation in the Christian theological medieval world-view. Broadly speaking, the impact of Islam on medieval Christianity redressed the imbalance between Faith and Reason which had existed in the philosophy of St Augustine.

Islamic medieval philosophers considered the study of Nature to be a religious duty which led to the recognition of God's signs in the cosmos. They saw the rational faculty of man as the "light of God" within the human temple, and also looked upon its use as a sacred activity. This contrasted sharply with early medieval Christian theology which regarded the study of Nature as a temptation to Sin. The most important feature of scholasticism is that it was first and foremost a religious revival, and only secondly an intellectual renewal. In fact the two were inseparably linked. In this sense, the rise of Christian scholasticism is an important precursor not only to the Renaissance, but more significantly to the Reformation. Just as Muslims pointed to the Quran as their only authority in matters of knowledge and wisdom, Christians started to point to the Bible as the

ultimate authority in their science and religion, as opposed to ancient manuscripts, or papal authority.

The Reformation and the Renaissance were two great changes in Europe which were interdependent, and were two sides of the same coin. They were both revolts against authority, based upon establishing fundamental rights of the individual: the right to interpret scripture according to one's own conscience, and the right to interpret the "book of nature" according to one's own reasoning and observations. Medieval Christendom was stirred into this spiritual and intellectual rebellion by the influence of the Islamic civilisation. The change in the Christian medieval religious world-view, inspired by Islam, provided the metaphysical foundation on which modern science was built, and was one that was able to harmonise Reason and Faith, and not emphasise one at the detriment of the other.

One of the most influential of Islamic philosophers in medieval Christendom was Averroes, an 11th century jurist, physician and philosopher from Cordoba in Spain. Averroes became so well known for his commentaries on Aristotle's works, that he was simply referred to as "The Commentator". His writings aroused considerable anti-clerical opposition and generally caused upheaval among the intelligentsia in 13th century Latin speaking Europe. During the 1270s, students and faculty members at Paris were defying traditional teaching under his name. The writings of Averroes were looked upon as subversive doctrines by 13th century church establishments and were condemned in an explicit list of 219 "errors"[21]. Different groups, first in France, and then later in Italy became known as "Latin Averroists".

The main themes pursued by Averroes in his writings were related to demonstrating the intrinsic harmony between Reason and Faith, to extol Muslims to study Nature as a sacred duty, and to promote the use of rational and logical principles in this study. He constantly referred to the Quran as his source of authority for these teachings. For instance, in a treatise entitled "Kitab fasl al-maqal" (on the Harmony of Religion and Philosophy), he states that the Quran enjoins Muslims to study Nature, use rational principles, and make use of ancient wisdom:

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[21] T. Goldstein, *The Dawn of Modern Science*, p 125

> "That the Law summons to reflection on beings, and the pursuit of knowledge about them, by the intellect is clear from several verses of the Book of God (Quran), Blessed and Exalted, such as the saying of the Exalted, "Reflect, you have vision" (Quran S. LIX,2) this is textual authority for the obligation to use intellectual reasoning.....Another example is His saying "Have they not studied the Kingdom of the heavens and the earth, and whatever things God has created." (Quran S. VII, 185)...therefore we are under an obligation to carry on our study of beings by intellectual reasoning... From this it is evident that the study of the books of the ancients is obligatory by Law... "[22]

The Law here, refers to an explicit commandment of God, and is for a Muslim the greatest possible form of injunction. Another central feature to the philosophy of Averroes is the proposition that theology and philosophy cannot contradict one another. It is not merely the stance of holding the two to be compatible, but the view that they cannot conflict - as a matter of principle. His position on matters where theology and philosophy appear to conflict is to interpret Scripture allegorically. He says: "Muslims accept the principle of allegorical interpretation, they only disagree about the extent of its application"[23]. For Averroes, the use of Reason in studying Nature can only reveal the handiwork of God. He likens Nature to be a piece of art which glorifies the Artisan:

> "If the activity of 'philosophy' is nothing more than study of existing beings and reflection on them as indications of the Artisan, i.e. inasmuch as they are products of art (for beings only indicate the Artisan through our knowledge of the art in them, and the more perfect this knowledge is, the more perfect the knowledge of the Artisan becomes), and if the Law has encouraged and urged reflection on beings, then it is clear that what this

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22 Averroes, *On the Harmony of Science and Philosophy*, p 44-5

23 ibid., p 51

> name signifies is either obligatory or recommended by the Law."[24]

In another passage he states that "true science is knowledge of God":

> "You ought to know that the purpose of Scripture is simply to teach true science and right practice. True science is knowledge of God... Right practice consists in performing the acts which bring happiness and avoiding the acts that bring misery and it is knowledge of these acts that is called practical science".[25]

Thus for Averroes there is a fundamental unity between science, religion and living a moral life. All are different forms of "science", and all are inextricably linked together in the "knowledge of God". This view was characteristic of all the great medieval Islamic philosophers and contain the essential principle of scholasticism - a universal sense of divine unity. Although the main thrust of Averroism was at first opposed by medieval Christian institutions in the 12th and 13th centuries, it was thereafter gradually incorporated into Christian doctrine.

The great Persian theologian, philosopher and physician, Avicenna, born 1080 AD, was also well known to medieval Christendom in the 12th and 13th centuries. Apart from his treatises in science, some of which remained standard text in the field of medicine up to the 17th century in medieval Europe, he was particularly influential in moral philosophy and theology - in such subjects as analysing rational proofs for the existence of God and the Soul.

In his treatise "On the existence of the Soul", he argued that Reason is the most important of all human characteristics and that it is essentially a spiritual phenomenon - immortal, and a sign of God within Man. He formed a synthesis between Greek thought, particularly Aristotelian and Islamic theology, which was to become very influential in Latin speaking

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[24] Averroes, *On the Harmony of Science and Philosophy*, p 44

[25] ibid, p 63

Europe. The religious character of man's reasoning power was described in the following way:

> "The activity most distinctive to the human soul is knowing consciousness. It has many uses, including acknowledgement, recognition, and worship of God. For when a person knows his Lord in thought, apprehends His identity in the mind, sees His grace mentally, by of reason, he ponders the very essence of God's creative act. One sees the perfection of the Truth Itself in the celestial bodies and supernal substances, recognising that they are the most perfect of all created things... one sees in one's own rational self a being akin to the very eternity and rationality of the heavenly bodies, and one rises in thought to the Commanding Word of the Unseen and recognises that command as well as creation are His, as He says, "Are not creation and command His?" (Quran 52:7). For the flowing forth of creation is entailed by His command".[26]

In this passage, it is clear that the rational self is a divinely created self which of all human qualities bears the most likeness to God, unlike the situation in Augustin's philosophy, where the Greek emphasis on reason was seen to be contrary to the spiritual path of salvation. For Avicenna, use of reason was a spiritual act, and significantly, he quotes the Quran for the source of this belief.

The rationalism of the 17th century underlying the world-view of the pioneers of the scientific revolution was profoundly shaped by Avicenna's philosophy. For instance, Descartes's famous "Cogito ergo sum" (I think therefore I am), demonstrating the primacy of the mind over the senses derived much from Avicenna's "floating man" example:

> "One of us must suppose that he was just created at a stroke, fully developed and perfectly formed but with his vision shrouded from perceiving all external objects -

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[26] Lenn E. Goodman, *Avicenna*, p 167

> created floating in the air or in space, not buffeted by any perceptible current of the air that supports him, his limbs separated and kept out of contact with one another, so that they do not feel each other. Then let the subject consider whether he would affirm the existence of his self. There is no doubt that he would affirm his own existence, although not affirming the reality of any of his limbs or inner organs, his bowels, or heart or brain, or any external thing. Indeed he would affirm the existence of this self of his while not affirming that he had any length, breadth or depth. And if it were possible for him in such a state to imagine a hand or any other organ, he would not imagine it to be a part of himself or a condition of his existence."[27]

By imagining a situation where all sensory stimulation is withdrawn, Avicenna concluded that the mind is in some sense more fundamental to the human self than the body. It is closely related to attempting to doubt the existence of the senses, as done for instance, in the philosophy of Descartes. This "floating man" example was widely discussed in medieval Christendom, and Descartes would have certainly been familiar with it. Of course, within the Christian tradition, Augustine had already articulated the primacy of the mind over the senses[28]. But Augustine de-emphasised human reasoning with respect to man's goal of salvation, and even referred to it as a "temptation to sin", so that theologically, Reason was faulty. Avicenna on the other hand, described the rational faculty as a way of discovering God's signs in the universe, and it was this latter approach that was to become characteristic of the 17th century pioneers of science.

In his arguments for the existence of God, Avicenna not only discussed considerations that relate to the First Cause or the inherent Design in the universe, but also provided a version of what has come to be known as the "Ontological argument for the existence of God" which was later developed by St Anselm in the 13th century. This argument, in keeping

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[27] Lenn E. Goodman, *Avicenna*, p 155

[28] B. Russell, *History of Western Philosophy*, p 353

with the mind being a sign of God in the cosmos - demonstrates the existence of God - based upon the idea of God[29]. Rational arguments for the existence of God became a prime activity for Islamic scholastic philosophy and was continued in Jewish and Christian scholasticism.

Roger Bacon, the 13th century Englishman, already mentioned in connection with Islamic science, and famous for being one of the first to use modern scientific methods in Christian medieval Europe, referred to Avicenna as "the prince and leader of philosophy"[30]. Apart from performing many experiments based on Alhazen's work in optics, he is well-known for his accurate predictions on what science would discover. Notably, Roger Bacon cited Avicenna and Averroes to support the view that scientific knowledge was not to be argued from ancient authority but must entail the independent use of Reason[31].

Another sign of the respect and influence that Avicenna and Averroes held amongst the Christian scholastics was that in "Inferno", the famous work of the 14th Italian poet Dante, they were consigned to Purgatory, rather than Hell - this was an unusually high position to occupy for mere "infidels".

In connection with understanding the impact of Islamic philosophy on medieval Christendom, a point needs to be made on how the conflict of science and religion appeared to the medieval mind in general. A scientific way of looking at the world was identified with the work of Aristotle, and the harmony of science and religion was in large measure translated into the issue of whether Aristotle's philosophy was consistent with religious scripture. This explains why certain passages from Aristotle's writings, relating to the eternity of the universe or human immortality, became the focus of theological controversy, first in Islam, and then later in Judaism and Christianity.

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29 Brian Davies, *An Introduction to the Philosophy of Religion*, p 26-37

30 B. Russell, *History of Western Philosophy*, p 456

31 ibid., p 456

From the modern point of view, there is no scientific evidence which favours the eternity of the universe hypothesis, as opposed to the one based upon creation in time. But in the medieval period, the eternity of the universe was the scientific world view, for no reason other than that Aristotle had stated it to be so. Islamic philosophers, who advocated the Aristotelian world-view, such as Averroes and Avicenna, felt the need to clarify Islamic doctrines with respect to it, and set out to demonstrate that the Quran was consistent with Aristotle's philosophy. Avicenna for instance, argued that the creation of the universe is not to be viewed in time, but in terms of causation. The chain of causes that gives rise to the universe occurs not in time, but in terms of priority, that is, the universe is a timeless effect emanating from a cause lying outside time. Others within the Islamic world did not agree with him, and so a debate between the orthodox Muslims and the "philosophers" ensued.

Another area where Aristotle's writings set off a medieval theological controversy was with respect to the "Active Intellect" or "Agent Intellect". In his De Anima, Aristotle suggested that there was a passive and active part to the human rational soul, and human thinking arose out of the influence of the active part, an immortal entity known as the Active Intellect, on the passive part. The controversial element to this philosophy was that Aristotle appeared to imply that the Active Intellect was located outside the human mind.[32] Exactly what Aristotle had intended to mean is not clear from the original text, and a variety of different interpretations are possible. Averroes interpreted the Active Intellect to lie outside the human mind, and describes the human mind in mainly passive sensory terms. The Active intellect from this point of view, is the same for all mankind. Averroes' view appeared to reject personal immortality, and was thus brought into conflict with the orthodox religious view of the soul surviving death. His view bears resemblance to the "Atman" of Hinduism, which is often presented to be an impersonal entity transcending individual consciousness and individual identity. Avicenna on the other hand, located the immortal part of the soul within the human mind, which although inspired by the Active Intellect, was nevertheless, separate from it. Avicenna placed the Active intellect in a hierarchy of "divine emanations" where it took tenth place down a chain of causes which

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[32] Aristotle, *De Anima*, III, 5, 430a 10-25

emanated from God. Averroes' view in particular aroused opposition, both from within Islam, and later amongst Jews and Christians.

Averroes and Avicenna formed only a part of the long line of Islamic philosophers who developed scholastic philosophy over three centuries. The works of philosophers such as Al-Kindi, a 9th century Arab philosopher, and Al-Farabi, a 9th century Turk, were also known to the medieval Latin speaking world. Their commentaries on the scientific and religious aspects of ancient Greek philosophy, particularly on the writings of Plato and Aristotle, and how they were related to Islamic theology, helped to shape the chrysalis from which Christian scholasticism grew. They were by no means all in agreement. Al-Kindi wrote in favour of the creation ex-nihilo doctrine, while Al-Farabi advocated the eternity of the universe. But more importantly, they were united in their openness towards secular learning. Al-Kindi for instance wrote, "we should not be timid in praising truth and in seeking it, from wherever it may come, even it be from distant races and people different from us "[33].

Al-kindi concentrated on demonstrating the Unity of God. He gave many examples of the different types of unity known to man, and argued that the Unity of God was the most noble and singular amongst them. Like all other Islamic philosophers he put the attainment of Wisdom before the acquisition of knowledge. This was another major characteristic of scholastic philosophy. Although the acquisition of knowledge was encouraged by scholastics, it took second place to the "First Philosophy" (spiritual wisdom) which was regarded as the most important kind of knowledge. Al-Kindi stated:

> "The noblest part of philosophy and the highest in rank is the First Philosophy, is knowledge of the First Truth who is the cause of all truth. Therefore it is necessary that the perfect and most noble philosopher will be the man who fully understands this most noble knowledge; for the knowledge of the cause is more noble than knowledge of the effect..."[34]

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[33] S. M. Afnan, *Avicenna*, p 25

[34] A. L. Ivry, *On First Philosophy: Al-Kindi*, p 56

There is a certain irony here when the above statement is compared to the modern approach of acquiring knowledge from identifying causes. The process of scientific investigation seems to move along a chain of causes, where each newly discovered cause is in some sense more profound than the previous ones. The chain of causes uncovered by science seems to proceed along in a direction of greater simplicity, where the number of causes used to explain the world around us is constantly decreasing in number. The notion of a First Cause is but a natural extension of this process. The ultimate goal of all scientific investigation would of course, be to uncover a single cause, which could explain the range of our entire experience: explain ourselves, the universe, and our relationship to it. Viewed in this way, science and religion do not oppose one another, rather, religion starts where science ends.

Before Islamic medieval thought inspired the rise of Christian scholasticism, it proved to be the source behind the reformation period of another of the world's major religions, namely Judaism. The flowering of Jewish scholasticism in the 11th and 12th centuries took place under the auspices of the caliphate of Cordoba, and is another example of the fundamental religious unity existing between the Quran and the Bible: the golden age of Jewish philosophy echoed all the major scholastic themes already developed by Muslim philosophers. Jewish philosophers not only acted as a bridge between Eastern and Western medieval thought but also greatly added to it. From within their own Hebraic tradition, they affirmed the major tenets of scholastic thought and as in the case of their fellow Muslim compatriots around the same period, many of their scientific advances were founded upon this scholastic metaphysical ground.

The period of greatest stability for the Jews living in Spain occurred in the 10th century. At this time, the opulent Caliphs gave special consideration to philosophy and poetry. They protected their Jewish subjects by law, and allowed them to compete for the acquisition of wealth and honour on the same terms as their Muslim fellow-citizens. The learning of science, philosophy and poetry was consequently cultivated by the Jews with the same zest as by the Arabs. This period of religious enlightenment was crucial to the cultural progress inspired by Islam. Many of the philosophers and scientists who contributed to Islamic learning were actually Jews. In fact, so intermingled was their contribution with their

Muslim fellow-citizens, that when the Christian West came to absorb Islamic learning from Spain, they frequently mistook Jewish writers and philosophers to be Muslims.

But in the 11th century, some Caliphs began forcibly to convert Jews to Islam, and many Jews fled to neighbouring countries. Of course, this persecution was still mild compared to the mass progroms of Jews that occurred within medieval Christian communities. For the most part, both Jews and Christians were able to live in comparative safety and freedom under Islamic rule. When the Muslims were not preoccupied with converting the Jews to their faith, both Jews and Muslims benefited.

The dominant concern of Jewish scholasticism, as with Islamic scholasticism before it, was to demonstrate the harmony of science and religion. This characteristic was the motivating force behind the most famous of all Jewish scholastics, Maimonides, born at Cordoba in 1135 AD. Maimonides wrote in Arabic, as did most Jewish philosophers living in Spain. He frequently cited Islamic philosophers, with whose works he seemed to be quite well acquainted. In his, "Guide for the Perplexed", a long treatise written to demonstrate the unity between Jewish theology and Greek philosophy, he gave many reasons for studying science, each supported by references to the Torah. For example, he stated that:

> "You will certainly not doubt the necessity of studying astronomy and physics, if you are not desirous of comprehending the relation between the world and Providence as it is in reality, and not according to imagination... Consequently he who wishes to attain human perfection, must therefore study Logic, next the various branches of Mathematics in their proper order, then Physics, and lastly Metaphysics... The necessity of such a preparation and the need for such a training for the acquisition of real knowledge, has been plainly stated by King Solomon in the following words: "If the iron be blunt, and he do not whet the edge, then must he put to more strength; and it is profitable to prepare for wisdom" (Eccles x. 10); "Hear counsel and receive

> instruction, that thou mayest be wise in thy latter end" (Prov. xix. 20)[35]

Here, the studying of different sciences, Logic, Mathematics etc. are not only linked to the many counsels of acquiring wisdom in the Old Testament, but stated to be an important preparation for understanding scripture. Maimonides thought by studying the universe, traces of God could be found:

> "Nothing exists except God and this universe, and that there is no other evidence for His existence but this universe in its entirety and in its several parts. Consequently the universe must be examined as it is, the propositions must be derived from those properties of the universe which are clearly perceived, and hence you must know its visible form and nature. Then only will you find in the universe evidence for the existence of a being not included therein".[36]

But Maimonides like all other philosophers within scholasticism only saw the acquisition of such knowledge as a means to a spiritual end - an instrument to acquire spiritual wisdom. He stated that:

> "If the person does not know the measure of the cone, or the sphericity of the sun, it is not so important as not to know whether God exists, or whether the world exists without a God."[37]

Hence, scientific knowledge for Maimonides was always moderated by divine knowledge. He explained that the holding of a higher principle to the attainment of scientific knowledge should not deter one from studying science:

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[35] M. Maimonides, *The Guide for the Perplexed*, p 46

[36] ibid., p 113

[37] ibid., p 43

> "It was not the object of the Prophets and our Sages in these utterances to close the gate of investigation entirely, and to prevent the mind from comprehending what is within its reach, as is imagined by simple idle people, whom it suits better to put forth their ignorance and incapacity as wisdom and perfection... The whole object of the Prophets and the Sages in these utterances was to declare that a limit is set to human reason where it must halt."[38]

He explains that in Jewish scripture, the acquisition of knowledge is often symbolically referred to by the taste of honey: "My son eat thou honey, because it is good, and the honeycomb... so shall the knowledge of wisdom be unto thy soul." (Prov. xxiv:13,14). Through the imagery of honey, Maimonides explains that Jewish scripture counsels moderation in the acquisition of knowledge: "Though great, excellent, noble and perfect, it is injurious if not kept within bounds or not guarded properly..."[39]. He quotes scripture to support this interpretation: "It is not good to eat too much honey" (Prov. xxv. 27). These passages underlie a general core principal of scholasticism, in this case illustrated from the Jewish perspective: that knowledge was regarded as the servant of wisdom, and the attainment of wisdom was part of a wider spiritual quest. This search for wisdom did not detract from science, but nourished it.

On the subject of the eternity of the Universe, Maimonides was committed to the creation ex-nihilo doctrine, and thought that it was implied by Judaic doctrine. On the other hand, he felt the philosophical arguments often used to advocate it were faulty, and that in general, the arguments used by philosophers who favoured the eternity of the universe were much stronger. He thought that Aristotle had only proposed the eternity of the universe as a theory, and not stated it to be a fact. He set about both showing the limitations of the creation ex-nihilo and eternity of the universe arguments. In his discussion, his reference points were schools of thought within Islam.

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38 M. Maimonides, *The Guide for the Perplexed*, p 43

39 ibid., p 43

Maimonides discusses weaknesses in the arguments of a certain Muslim theological school called the `Mutakallemim', who advocated the creation ex-nihilo doctrine. He stated that their arguments were not consistent with the "laws of nature" and that they were based only upon religious bias.

He writes:

> "The first Mutakallemim tried to prove a proposition when it was expedient to demonstrate its truth; and to disprove it, when its rejection was desirable, and when it was contrary to the opinion which they wished to uphold.... I tell you, however, as a general rule, that Themistus was right in saying that the properties of things cannot adapt themselves to our opinions, but our opinions must be adapted to the existing properties".[40]

Not only did Maimonides think the Mutakallemim to be unscientific, but objected to them using the ex-nihilo doctrine to prove the existence of God. In fact, in connection with arguments concerning the existence and qualities of God, Maimonides preferred the writings of the "philosophers". These philosophers were Muslims, such as Al-Farabi. Maimonides specifically cites Al-Farabi on several occasions, whom he refers to as "Abunazar Al-Farabi". In one instance, he states that many of the arguments against the Mutakallemim had already been developed by Al-Farabi. Writing on the weakness of a Mutakallemim proposition, he states, "Yet all these things have no reality and are mere fictions. Abunazar Al-Farabi in criticizing this proposition, has exposed all its weak points, as you clearly perceive, when you study his book on the changeable beings earnestly and dispassionately"[41].

Although Maimonides criticises the philosophy of the Mutakallemim, he indicates that many Jews had accepted their beliefs and had not produced any original philosophy of their own. Writing of Jewish scholars, he wrote, "they followed the lead of the Mohammedian Mutakallemim, and what they wrote is insignificant in comparison with the kindred works of

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[40] Moses Maimonides, *The guide for the Perplexed*, p 110

[41] ibid., p 138

the Mohammedians"[42]. In another passage, Maimonides states that some Jewish thinkers identified themselves with the `Mu'tazilah', an Islamic theological school that flourished in the 8th and 9th centuries. In connection with the Islamic philosophers, he stated that "our Andalusian scholars followed the teachings of the philosophers, from whom they accepted those opinions which were not opposed to our own religious principles"[43]. All this shows that Jewish scholasticism arose out of the matrix of Islamic scholasticism and was inextricably linked to it.

A profound theological resonance between the Quran and Torah lies in the unity and essential transcendence of God. It was in this connection that the philosophy of Maimonides had its lasting impact. He described the route to God in a negative way: that God was best understood in terms of what He is not. Maimonides stated, "Know that the negative attributes are the true attributes: they do not include any incorrect notions or any deficiency whatever in reference to God while positive attributes imply polytheism, and are inadequate... we cannot describe the Creator by any means except by negative attributes.."[44]. Maimonides cites scripture for this view, "To whom, then, will you liken me" (Isaiah xl. 25), or "There is none like unto Thee" (Jer. x. 6)[45]. This is of course, a point of unity between Muslims and Jews, and there are many similar passages in the Quran, such as Sura 42:9, where it is written of God that, "There is nothing like unto Him".

The Christian scholastics were generally not as well informed about Islamic theology and philosophy as their Jewish counterparts. Their approach was generally a hostile one. There were of course, obvious political reasons for this, very few Christians could be seen to praise the enemy. From the 13th century onwards, the learning that Christian Europe absorbed from Islam was not generally acknowledged to be Islamic, but claimed to be a combination of Aristotelian philosophy and Christian theology. All these points are clear in the works of the most

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42 M. Maimonides, *The Guide for the Perplexed*, p 108

43 ibid., p 108

44 ibid., p 81

45 ibid., p 78

famous of all Christian scholastics, St Thomas Aquinas, a 13th century Italian priest.

Aquinas wrote the treatise, "Summa Theologicae" as an attempt to demonstrate the inherent harmony between Reason and Faith. On the one hand he encouraged the study of science stating for instance that: "There is a place for the authority of reason: the grace of God does not replace but fulfils it"[46], or elsewhere stating that: "We know God in all we know"[47]. On the other hand, in characteristic scholastic tradition, he emphasised the limits to human reason: "God has destined us for a goal beyond the grasp of reason"[48].

Aquinas derived much of his knowledge about Islamic philosophy from his Master, Albertus Magnus (Albert the Great), who lived in the early part of the 13th century. Albert Magnus was one of the greatest transmitters of Greek and Islamic philosophy to the Christian scholastic world, he spent over fifty years assembling one of the largest store houses of medieval learning in Europe. He frequently cited Avicenna in his works, to whom he referred with admiration and appreciation[49].

Aquinas, gives similar arguments to those presented by Muslim and Jewish scholastics before him, in describing how science and religion were compatible. The main message, that the use of reason unveils traces of God in the universe, and is in harmony with religious revelation, is in this instance, supported with references to Christian scripture. Aquinas gave four reasons, two of which are quoted below, of why he thought "consideration of creatures is useful for building up man's faith in God":

> "This meditation on the divine works is indeed necessary in order to build up man's faith in God. First, because through meditating on His works we are able somewhat to admire and consider the divine wisdom. For things

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46 St. Thomas Aquinas, *Summa Theologiae*, p 3

47 D. J. O'Connor, *A Critical History of Western Philosophy*, p 104

48 St. Thomas Aquinas, *Summa Theologiae*, p 1

49 Soheil M. Afnan, *Avicenna*, p 273

made by art are indications of the art itself, since they are made in the likeness to the art. Now God brought things into being by His wisdom: for which reason it is said in the Psalm: "Thou has made all things in wisdom" (Ps ciii: 24). Hence we are able to gather the wisdom of God from the consideration of His works, since by a kind of communication of His likeness it is spread abroad in the things He has made. For it is said (Eccles I:10), "He poured her out", namely wisdom, "upon all His works": wherefore the psalmist after saying: "The knowledge is become wonderful to me: it is high, and I cannot reach to it", and after referring to the aid of the divine enlightening, when he says: "Night shall be my light", etc., confesses himself to have been helped to know the divine wisdom by the consideration of the divine words saying: "Wonderful are Thy works, and my soul knoweth right well" (Ps cxxxviii: i-vi). Secondly, this consideration leads us to admire the sublime power of God, and consequently begets in men's hearts a reverence for God. For we must needs conclude that the power of the maker transcends the things made. Wherefore it is said (Wis. xiii:4), "If they", the philosophers, to wit, "admired their power and their effects", namely of the heavens, stars, and elements of the world, "let them understand....that He that made them is mightier than they". Also it is written (Rom. I: 29): "The invisible things of God.... are clearly seen, being understood by the things that are made: His eternal power also and divinity". And this admiration makes us fear and reverence God. Hence it is said (Jerem. x.6, 7): "Great is Thy name in might. Who shall not fear Thee, O King of nations?"[50].

The above references to biblical scripture from one of the greatest expounders of Catholic theology, conveys exactly the same meaning as the scripture quoted by Maimonides, and those quoted by Avicenna and

[50] St Thomas Aquinas, *The Summa Contra Gentiles*, The second book, chapter 2, p2-3

Averroes from the Quran, and indicate a fundamental line of unity between the Islamic, Jewish and Christian Faiths. Aquinas was however, writing against the former tradition of Augustine. The core of his message was not accepted by the European Christians of his day. He acknowledged this, and he specifically cited Augustine for being in error with respect to separating the "truth of Faith" and "opinions one holds about creatures":

> "Accordingly it is clear that the opinion is false of those who asserted that it mattered not to the truth of faith what opinions one holds about the creatures, so long as one has a right opinion about God, as Augustine relates in his book De Origine Animae: since error concerning creatures by subjecting the human mind to causes other than God amounts to a false opinion about God, and misleads the minds of men from God, to Whom faith strives to lead them"[51].

The considerable influence that Islamic philosophers had on 13th century Christian theologians is also apparent on the issue of the Active Intellect and the nature of the human soul. Aquinas wrote a treatise entitled, "On the unity of the intellect against the Averroists"[52]. In it, he quotes from the works of Avicenna and Abu Hamid Al-Ghazzali, an 11th century sufi mystic Islamic theologian who lived in Bagdad. Ghazzali was known as Algazel in Christian Europe.

After citing the views of Avicenna and Algazel on the soul, Aquinas, states, "Now these things we have said first, not as though wishing to reject the above error by the text of the philosophers; but to show that not only the Latins, whose words some do not relish, but also the Greeks and the Arabs were of this opinion.."[53]. This citation indicates that Aquinas wrote his treatise not for Muslims, but for his fellow Christians who held

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[51] St Thomas Aquinas, *The Summa Contra Gentiles*, The second book, chap 3, p 6

[52] St Thomas Aquinas, *On the unity of the intellect against the Averroists*

[53] ibid., p 46-7

the writings of the "Greeks and Arabs" in great esteem, and who were committed to Averroes' conception of the human soul.

Elsewhere in the same treatise, Aquinas states, "Now what they [the Averroists], say is clearly false, namely that it was a principle among all philosophers, both Arabs and Peripatetic, though not among the Latins, that the intellect is not multiplied numerically. For Algazel was not a Latin, but an Arab. Avicenna, too, who was an Arab, speaks this in his book, On the Soul,..."[54]. The Latin "Averroists" were particularly active at Paris in the 12th century, such as the Priest, Siger of Bibrant. Here, Aquinas also appears to be unaware that Avicenna was a Persian. He thought that Algazel wrote in support of Avicenna's works, by only having an incomplete part of Algazel's works. In fact, the opposite was true, Algazel's work, "On the incoherence of the philosophers", was actually a refutation of Avicenna's philosophy[55].

Although Aquinas had rejected Averroes' conception of the human soul, he had in large measure accepted the Avicennian hypothesis that the Active Intellect was located outside the human soul. Like Avicenna, he believed the human soul to be immortal and thought that the function of the Active Intellect was to inspire and cause progress in the soul. The Avicennian synthesis of the Aristotelian and Islamic doctrines of the soul was accepted by most Christian scholastics with minor modifications. The transmission of Avicenna's views, apart from Latin translations of his work De Anima, were made by some Christian theologians, such as the Italian priest Gundisalvi, who lived in Spain in the 11th century, and who was a translator of many Islamic works[56]. Gundasalvi wrote a treatise entitled `De Anima', where he essentially advocated an Avicennian doctrine of the soul. The historian D. Knowles notes that:

> "The great scholastics of the mid-thirteenth century, who had been nurtured for the most part upon the Augustinian noetic...were now presented with a rich

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54 St Thomas Aquinas, *On the unity of the intellect against the Averroists*, p 72

55 ibid., p 46

56 D. Knowles, *The Evolution of Medieval Thought*, p 196-7

> literature of the works upon the soul and its powers, stretching back from Gundisalvi and the Arabs to the works of Aristotle. Their first impulse was to apply the system of Avicenna to clarify that of Augustine, making of the agent intellect of the former the divine illumination of the latter. Then, when Averroes appeared, with his commentary on Aristotle, they were faced with new difficulties. Some, and among them, Siger of Bibrant, at least in the early stages of his career, adopted the Arabian philosopher's solution of the problem. Others, and chiefly Albert the Great, and Aquinas, while using both Avicenna and Averroes, based themselves on the pure doctrine of Aristotle's De Anima..."[57].

Aquinas claimed that he based his theology on the philosophy of Aristotle and the Bible, historically, this misleading interpretation of scholasticism has come to dominate European history. It is however, only partially true. Aquinas, as with his Master Albertus Magnus, largely adopted an Avicennian conception of the soul, where the religious doctrine of the immortality of the soul was combined with Aristotle's Active Intellect.

The 17th century pioneers of modern science were for the most part scholastic disciples. Their continual emphasis on science uncovering the handiwork of God; of the intrinsic harmony between Reason and Faith; the acquisition of Wisdom being the supreme human goal; the limits to human reason when compared to the world of God, all these sentiments echoed medieval scholastic philosophy. Moreover, the natural harmony between reason and faith incorporated in such a vision, was vital to the growth of modern science.

5. The Renaissance Man

It is often thought that the Humanist philosophy which lay behind the Renaissance was a rebellion against Scholasticism[58]. But this was true

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[57] D. Knowles, *The Evolution of Medieval Thought*, p197

[58] B. Russell, *History of Western Philosophy*, p 487

only with respect to the details of scholasticism and not with respect to its general principles. Those elements of scholastic philosophy which incorporated Aristotle's specific theories - such as his earth-centred cosmology, were overturned. But this did not destroy the foundation of scholasticism. In fact quite the reverse is true. The Renaissance was a time where much of the unity formulated within scholasticism came to fruition.

"L'uomo universale" of the Renaissance was artist, craftsman, philosopher, inventor, humanist, scientist, astronomer and monk all in one. Science, Religion and Art were so intermingled that it was difficult to distinguish between them. It is not easy to tell whether a drawing of Leonardo da Vinci was intended as a piece of art or for anatomical demonstration - it was seemingly for both. A similar situation existed for maps: were they pieces of art or drawn to guide travellers? The answer again seems to be both. In fact scientific developments evolved side by side with artistic innovations. Map projection for instance developed alongside perspective drawing for 150 years during the Renaissance period, both locked together in a mutually fruitful relationship. The construction of Gothic cathedrals united technical dexterity, artistic beauty, and spiritual aspiration - all in one. They epitomised the scholastic vision of Reason being harmoniously guided by Faith. They were all external symbols demonstrating the medieval belief in an inner universal order.

The inner spiritual aspirations of Renaissance man and his harmonious relationship to his environment take material form through the Gothic cathedral. The moral, the rational, the empirical, the artistic, the physical, all find union in a building directed towards the world of God.

Another common misconception concerning humanism is that it arose out of a resurgence of Plato's philosophy in Europe, and in particular, to the Pythagorean elements within Plato's philosophy. According to this view, the universe as a mathematical order, inherent in Pythagorean-Platonic philosophy began to replace the influence of Aristotelian Logic in European intellectual thought[59].

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[59] E. A. Burtt, *The Metaphysical Foundations of Science*, p 52-3

While it is true that the humanist movement did place greater emphasis on mathematics rather than logic, this influence did not only come from ancient Greece. In fact the period between the 14th to 16th centuries saw the fresh translations of Islamic mathematical manuscripts into the Latin speaking world, and as a result, a renewed interest in mathematics in Europe was engendered. Both Algebra and Trigonometry were transmitted to medieval Christendom during this time. Biagio for example, an Italian mathematician, living in the 14th century, presented simple algebraic operations as a part of practical arithmetic. In the 15th century quadratic equations were solved by geometric means - as they had been in the Islamic civilisation. These developments in Islamic science were transmitted primarily via universities in Italy. Studies in trigonometry were made from Arabic texts by Regiomontanus, a German astronomer who lived in Northern Italy in the 15th century.

Regiomontanus made explicit use of the sine function, stated the laws of the sines, and wrote a treatise on spherical trigonometry, from which Copernicus is supposed to have borrowed but not acknowledged. Regiomontanus built his own astronomical observatory, and is regarded as one of the first astronomers in Latin speaking Europe who succeeded in treating astronomy as an exact science. The work of 17th century scientists drew much from his astronomical work. In fact Regiomontanus is known to have hinted at the notion of the motion of the earth, long before Copernicus formulated the heliocentric theory. Regiomontanus stated that: "It is necessary to alter the motion of the stars a little because of the motion of the earth"[60].

Another humanist, vital to the development of Renaissance science in the 15th century was the German ecclesiast-mathematician, Nicholas of Cusa, who also lived in Northern Italy. Nicholas of Cusa is most famous for his statements concerning the earth not being at the centre of the universe and being in motion. He made these statements at least twenty years before the Copernican theory was formulated. Nicholas of Cusa stated for instance, that:

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[60] A. Koestler, *The Sleepwalkers*, p 212

> "Since, then, the earth cannot be at the centre, it cannot be entirely devoid of motion... It is clear to us that the earth is really in motion though this may not be apparent to us, since we do not perceive motion except by comparison with something fixed."[61]

Neither did Nicholas of Cusa confine his thinking to Aristotelian principles of uniform motion, or circular Platonic celestial orbits, in which he was, in both respects, well ahead of his time - certainly far beyond the later conceptualisations of Nicholas Copernicus. Cusa maintained that:

> "Moreover, neither the sun, nor the moon, nor any sphere - though to us it seems otherwise - can in (its) motion describe a true circle, because they do not move around a fixed base... nor is (anything) ever at one time (exactly) as at another, neither does it move in a precisely equal (manner)..."[62]

Cusa also believed that stars were made of the same kind of materials found on earth, thus refuting the ancient Greek notion of the heavenly bodies being stainless and perfect. He stated for instance that:

> "...It cannot be said that this place of the world (is less perfect because it is) the dwelling place of men, and animals, and vegetables that are less perfect than the inhabitants of the region of the sun and of other stars..."[63]

In all these remarkable speculations, Nicholas of Cusa exhibited a rebellion against the traditional knowledge of his day. He based much of his speculations on the conception of the universe as a mathematical order, which has no natural centre and is unbounded. Cusa for instance stated that:" number is the first model of things in the mind of the

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61 A. Koestler, *The Sleepwalkers*, p 209

62 ibid., p 209-10

63 ibid., p 210

Creator"[64]. Nicholas of Cusa gained much of his mathematical knowledge from Islamic sources. He read the Arabic language and was considered to be one of the most knowledgeable Europeans on the Islamic culture of his period. In fact Cusa wrote a treatise on the Quran in which he stated that the prophet Mohammed's impulse to be essentially good, and that the Quran had genuine religious merits. His treatise, although a Christian polemic against Islam, was nevertheless quite unlike the blatantly abusive Christian polemics against Islam of his period. Cusa favoured establishing a dialogue as a means of settling Islamic-Christian rivalries. In fact he was involved in Peace negotiations with the Turkish Islamic world in the hope of averting war in the early 15th century.

Cusa's dissatisfaction with the Ptolemaic theory was no doubt also influenced from the controversy surrounding the theory within the Islamic civilisation. Some Muslim philosophers objected to the Ptolemaic system on the grounds that it did not conform to the Aristotelian principles of uniform motion in its complex system of epicycles. Alternative astronomical schemes were devised which did not violate any Aristotelian principles of motion. Although these schemes were not successful, they were known to the Latin speaking world. It was precisely this controversy that led Averroes to state that: "The Ptolemaic astronomy is nothing so far as existence is concerned; but it is convenient for computing the non-existent"[65]. Such statements would have been well-known to Cusa, and perhaps indirectly to Copernicus, who set about revising the Ptolemaic theory precisely for the reasons of it not conforming to the Aristotelian principle of uniform motion. At the Universities of Cracow and Bologna where Copernicus studied, the mathematical tradition of Cusa and Regiomontanus was very much alive. In fact Copernicus at the beginning of his "Book of the Revolutions of the Heavenly Spheres" had put the motto: "for mathematicians only"[66]. There is no doubt that the wider influence of Islam, not just the rediscovery of ancient Pythagorean-Platonic harmonies within Latin speaking Europe, lay at the foundation of the humanistic movement of the Renaissance. Nicholas Rescher, in his

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64 E. A. Burtt, *The Metaphysical Foundations of Science*, p 53

65 A. Koestler, *The Sleepwalkers*, p 209

66 ibid., p 222

book "Arabic Studies" has written of this Islamic influence in the following way:

> "In the Italian Renaissance of the 15th to mid-16th centuries, Averroism exerted a great influence in the study of the philosophy of nature at Padua and Bologna, with the result that Arabic philosophy was operative as a significant force in the intellectual ferment that underlay the work of Galileo and saw the beginnings of modern science."[67]

Single events in history rarely explain very much on their own. They may sometimes serve as a convenient marker to separate different periods in history, as events relating to the progress of science in the 17th century signify the beginning of a modern era in our history and the end of a medieval one. But such historical dividing lines are clearly plagued with an inherent degree of arbitrariness and inaccuracy. The dangers of compartmentalising history by these rough markers should always be borne in mind and one should be willing to revise the boundaries. Any historical event takes place in a wider scheme of beliefs and perceptions. Events are integrally linked to and formed out of a certain world-view, sometimes articulated, but more often than not, unexplicated. To choose a once popular turn of phrase, events are formed within a certain Weltanschauung. The roots of the modern scientific world go back much further than the 17th century. The background "Weltanschauung" from which the scientific discoveries of the 17th century were made, was initiated by the rise of Islam in Arabia, formulated in its essential characteristics under the spectacularly cosmopolitan Islamic culture, further developed as it gradually gave rise to Jewish and Christian scholasticism, and culminated in the explorations and historical revolts of the Renaissance. There is no simple dividing line between the medieval era and the modern one, just as there is no single culture from which the European Renaissance grew. The Renaissance is not European, neither is the 17th century uniquely modern compared to the centuries before it.

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[67] N. Rescher, *Studies in Arabic Philosophy*, p 157

During the so-called "Dark Ages" in Latin speaking Europe, generally thought to be barren for the progress of science, vital technological developments were made from which the craft tradition of the European Renaissance grew. It was during this period for instance that the heavy-wheeled plough was invented, which allowed the use of horses in the process of ploughing, thus saving labour and time. The invention of the water-wheel also dates from this "Dark" period, which was subsequently used in Mills to grind corn, creating a food surplus - without which the building of towns, cathedrals, universities etc. during the Renaissance period could not have been carried out.

Opening up the scope for sea travel, the medieval inventions of the stern-post rudder, Lateen Sail, and bowsprit, enabled boats to be kept at sea for months on end. The historian Arnold Toynbee compares the increase in sea exploration with the steppe-borne horse used earlier by the Eurasian nomads in the following way:

> "The steppe-borne horse had conveyed its nomad rider to the back doors of all the civilizations of the Old World; the Ocean-borne ship conveyed its Western navigator to the front doors of all civilizations on the face of the planet. The Modern Western sailing-ship was an instrument and the symbol of the West's ascendency in the World during a Modern Age of Western history..."[68]

The widespread exploration of the seas, the revolution in crafts, arts and sciences during the Renaissance period, were made possible only through these aforementioned "Medieval" inventions.

The Renaissance arose out of a world-wide interpenetration of cultures. The craft tradition that arose during the Renaissance, generally acknowledged to be the forerunner of the empirical method in modern science, owed much of its development to Chinese science. The introduction of Chinese inventions such as the magnetic compass, gunpowder, and paper making into Europe during the early Renaissance period greatly facilitated the subsequent rise of 17th century science.

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[68] A. Toynbee, *An Historians Approach to Religion*, p 145

Paper making, which came via the Islamic civilisation in the form of block-printing, led to the dramatic rise in literacy which is well-known for having made the historical revolt of defying Papal authority possible - by making copies of the Bible available to everyone who could read. Moreover, the popular rejection of the authority of the ancient Greeks in secular learning, a characteristic feature of humanist philosophy during the Renaissance, was also made possible only by their writings attaining a wide degree of accessibility through the use of printing.

The Renaissance was a time of discovering New Worlds. The sense of adventure and exploration that arose from these discoveries was felt well into the 17th century. Francis Bacon, the famous 17th century populariser of modern science wrote the following about the new spirit of discovery:

> "The world sailed around, the largest of the Earth's continents discovered, the compass invented, the printing press sowing knowledge, gun-powder revolutionising the art of war, ancient manuscripts rescued and the restoration of scholarship, all witness to the triumph of our New Age."[69]

It was this confidence in a New Age, of new explorations and adventures that characterised the vision of the 17th century pioneers of modern science. They enthusiastically embarked upon a path of intellectual discovery with the same zeal and sense of adventure that their predecessors had set about charting the unknown seas of Africa, or set about sailing for the "New World". Yet all these advances and discoveries were made with an underlying medieval conviction of an inner moral order.

The great exploits and discoveries of the Renaissance have their roots in the spiritual renaissance of an inner vision. It was a vision that was mathematical as well as being spiritual, rational as well as moral, artistic as well as scientific. All these advances, including those made within 17th century science, carry with them an inner confidence, a balance of science and religion that took centuries to develop, in which three of the world's

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[69] J. Marks, *Science and the Making of the Modern World*, p 44

major religions, working from within their own spiritual traditions came to harmonise their theology with ancient forms of wisdom and give inspiration to the rediscovery of nature. The metaphysical ground upon which the Renaissance and the modern scientific revolution stood was not only multi-cultural, but also multi-faith. Modern science grew out of the chrysalis of religious world-views.

6. Medieval Islam and Bahá'í Teachings

There are aspects of medieval Islam that correlate with and help clarify some Bahá'í teachings. The first relates to the Bahá'í belief that civilisations are founded by religion. 'Abdu'l-Bahá, after describing the great cultural achievements of Islam, writes, "The purpose of these references is to establish the fact that the religions of God are the true source of the spiritual and material perfections of man, and the fountainhead for all mankind of enlightenment and beneficial knowledge"[70] . The culture inspired by Islam, including its impact on the Christian West, provides one of the most clear examples in all religious history of the civilising effects of religion. This paper has attempted to illustrate how characteristics vital to the success of Islamic culture, such as its openness to all forms of learning, its inherent balance between science and religion, and religious tolerance, can be directly traced to the text of the Quran.

The second observation concerns the relationship of science and religion. From the Bahá'í perspective, the harmony of science with religion is a fundamental balance upon which individual and collective progress is made. Religion and science are likened to the two wings of a bird. Around the turn of this century in Paris, 'Abdu'l-Bahá stated that:

> "Should a man try to fly with the wing of religion alone he would quickly fall into the quagmire of superstition, whilst on the other hand, with the wing of science alone

[70] 'Abdu'l-Bahá, *Secret of Divine Civilization*, p 94

> he would also make no progress, but fall into the despairing slough of materialism"[71].

The importance of harmonising religious beliefs with science is clearly reflected in the success of Islam. Generally speaking, the most influential strand of thought in early medieval Christendom tended to reject science in favour of religion, and as a result, European Christian communities were characterised by a "quagmire of superstition". The impact of Islam redressed this balance. Both Islamic civilization and the European Renaissance which Islam inspired, were characterised by their harmonious integration of scientific, artistic and religious sentiments. Many of those who contributed most to cultural progress during these periods operated simultaneously as philosopher, theologian, scientist, artist, and engineer.

The need for a balance between science and religion is also an urgent concern today. But unlike the medieval period, the most influential strand of thought in modern times rejects religion in the name of science, and many of today's modern societies evoke 'Abdu'l-Bahá's image of being in a "slough of materialism". Redressing the balance today may well involve strengthening religion.

The third observation relates to the search after truth. In the Bahá'í Faith, an earnest "search after truth" is a fundamental prerequisite to establishing the harmony of science with religion and also the fundamental unity between religions. 'Abdu'l-Bahá stated this principle in the following way,

> "When we are earnest in our search for anything, we look for it everywhere. This principle we must carry out in our search for truth. Science must be accepted. No one truth can contradict another truth. Light is good in whatsoever lamp it is burning! A rose is beautiful in whatsoever garden it may bloom! A star has the same radiance if it shines from the East or from the West. Be free from prejudice, so you will love the Sun of Truth

[71] 'Abdu'l-Bahá, Paris Talks, p 143

> from whatsoever point in the horizon it may arise! You will realize that if the Divine light of truth shone in Jesus Christ it also shone in Moses and in Buddha. The earnest seeker will arrive at this truth. This is what is meant by the 'Search after Truth' "[72]

It is perhaps no accident that medieval Muslim religious tolerance and cultural diversity went hand in hand with an openness to learn from ancient secular and religious traditions. The search after truth by medieval Muslims led to their appreciation and assimilation of cultures as far away as China and India, and was a decisive factor in their cultural success.

The search after truth is not the primary characteristic which is associated with religious people today. This study of Islamic civilisation suggests that for a spiritual and cultural renaissance to recur, religious people must once again become genuinely truth orientated and truth centred, so that they can rise above their theological prejudices, not just in their words, but in their deeds.

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[72] 'Abdu'l-Bahá, *Paris Talks*, p 137

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